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AUTHOR	Cordes, David C.
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ABSTRACT

This report describes the CAMPUS-V, a computer based simulation model with an ability to represent "reality" in considerable detail. CAMPUS is an acronym for Comprehensive Analytical Methods for Planning University Systems, and was developed by the Institute for Policy Analysis in the University of Toronto. This report briefly discusses: (1) the resource data required for each course or activity; (2) the definitions of the terms used; (3) the command structure; and (4) the CAMPUS subroutine calling sequence. The bulk of the report deals in greater detail with the inputs, the process, and the outputs of the 20 subroutines. (AF)

Project PRIME Report No. 8

AN OPERATIONAL OVERVIEW OF THE CAMPUS SIMULATION MODEL

by

David C. Cordes

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AN OPERATIONAL OVERVIEW OF
THE CAMPUS SIMULATION MODEL

HISTORY AND BACKGROUND

CAMPUS is an acronym for Comprehensive Analytical Methods for Planning University Systems. CAMPUS was developed under a Ford Foundation Grant by the Institute for Policy Analysis in the University of Toronto. The Institute has an extensive research program entitled "Systems Analysis for Efficient Resource Allocation in Higher Education." The program consists of six integrated projects: (1) Program Planning and Budgeting in Universities; (2) Planning and Financing Higher Education; (3) Models for University Planning (CAMPUS); (4) Integrated University Information Systems; (5) Models for planning and use of physical facilities; and (6) Planning and Management Systems for University Information Resource Centers.1/

CAMPUS development began with a pilot study in December 1964. The model has evolved through five revisions with CAMPUS V becoming available to the public (at a nominal cost of approximately $100) in early 1970. For a historical perspective on the evolution of CAMPUS I-IV see [Judy, Oct. 1969].

Another version of CAMPUS, labelled either CAMPUS VI or CAMPUS-CONNECT is available from the Systems Research Group [Systems Research Group, August 1970]. The principle difference between CAMPUS V and CAMPUS VI is that the latter allows the user to interact in a "batch" model. The basic approach to resource modelling, data structuring, and simulating are similar in both models. CAMPUS V will be used in all succeeding discussions in this study.

The Journal articles and speeches available describing CAMPUS are numerous: [Judy, 1969; May 14-15, 1969]; [Judy and Levine, 1966]; [Levine, 1969, Oct. 1969]; Sceviour, April 1969]; [VanWijk, 1970] and [Youston, et.al., 1968]. Also there is documentation available with the System [Judy et.al., 1970]. However these reports and available documentation do not describe CAMPUS in sufficient detail to access its capabilities and limitations.2/ Questions like the

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1/For a description of each project, their objectives, and their status at the end of 1969 see Judy, Richard W. "A research progress report on Systems Analysis for efficient resource allocation in higher educations," University of Toronto, January 1, 1970.

2/The reports tend to describe what CAMPUS "might" do, or what is "planned." This is not meant as a criticism, for the development of CAMPUS is an ongoing effort. The documentation describes the computer logic in detail, but does not answer the "management" oriented questions posed above.

following cannot be answered from the available literature: How large an institution can CAMPUS V handle? What capability does the model have for converting budget data to program element data? How does the student flow model really work? To what level of detail can CAMPUS "represent reality?" How does CAMPUS construct a degree program? How does it handle the support programs?

OVERVIEW OF MODEL

CAMPUS V is a computer-based resource simulation model with an ability to "represent reality" in considerable detail. An extensive study of University planning models called CAMPUS "the most detailed of the educational planning models currently available" [Weathersby and Weinstein, 1970: 14]. As an indication of this level of detail, each course (or Activity) in CAMPUS requires the following resource data:

(1) STAFF - academic (e.g. professor) and academic support (e.g. teaching assistant);

(2) SPACE - classrooms, instruction labs, or special labs;

(3) TEACHING EQUIPMENT - projectors, bunson burners, computers, etc.;

(4) TYPE OF COURSE - lecture, lab, individual study, etc.;

(5) STAFF SPECIALIZATION - accounting, philosophy, art, etc.;

(6) SCHEDULE TIME - hours per class and classes per week;

(7) SUCCESS FACTOR - probability of completing courses with a passing grade.

Definitions:

Before the author can continue in this overview of the CAMPUS model, it is necessary for maximum understanding to define several key variables. These definitions will be adherred to in the remainder of the report.

(1) COST CENTER: A unique sub-set of area of the organization being modelled for which resources are required. The prevalent cost center in higher education is the academic department. Other example cost centers include: research centers, libraries, and Dean's offices. An example of a cost center structure is shown on Figure 1. The example has ten cost centers at three "Levels." (Cost centers 5-10 are all level "1").

(2) PROGRAM STRUCTURE: A grouping of the organization's activities and programs in a manner that indicates their relationship to the organization's goals and objectives - Figures 2a and 2b sample program structures.

(3) ACTIVITY: An activity is an event or action that requires resources from a cost center. The typical activity in higher education is a course or section. Other examples of activities include advising students on dissertations and conducting oral exams.

(4) STUDENT: In CAMPUS a student refers to one person taking any load. Headcount would be a synonymous term.

(5) ENROLLEE LOAD: One enrollee load is one "student" taking one activity (course). Thus, an enrollee load of five could then be either five students taking one course or one student taking five courses.

(6) AFFILIATED STUDENTS: A headcount of students "affiliated" with a particular cost center (i.e., a mechanical engineer in the mechanical engineering department).

(7) AFFILIATED ENROLLEES: An indication of load put on a cost center by its affiliated students.

(8) ACADEMIC STAFF (full time): The professional staff at academic cost centers who are considered in the hiring and promotion policies. Typical ranks include Professor, Associate Professors, Assistant Professors, Instructors, Lecturer.

(9) ACADEMIC STAFF (part-time): Staff that participates in teaching activities, but who are not considered in the hiring and promotional policies. A typical rank would be Teaching Associate.

(10) ACADEMIC SUPPORT STAFF: Staff that participates in teaching activities, but do not have control of the course. This staff is typified by teaching assistants, graders, tutors.

(11) NON-ACADEMIC SUPPORT STAFF: This staff type refers to secretaries, research associates, research assistants or "civil service" staff available at academic cost centers.[1/]

(12) SERVICE DEPARTMENT: A non-academic sub-unit within the organization that has requirements and responsibility for resources, e.g. staff, equipment, space. Examples include a computer center, placement office, etc..

(13) SIMULATION PERIOD: Either quarter or semester.

(14) SESSION: An academic year consisting of a number of simulation periods (i.e., two for a semester system).

(15) FUNCTIONAL OR PROPORTIONAL BASIS: This is a procedure in CAMPUS for determining the amount of required resources as a function of various measures of cost center activities. An example of a possible function for determining the required amount of computer supplies for the Accounting Department might be as follows:

[1/]Non-Academic Support Staff can be "modelled" in CAMPUS at any cost center (academic or non-academic), however it is necessary to restrict this type of staff to academic cost centers because of the "program costing module" - see Project PRIME Report No. 5 for a discussion of "program costing".

Computer Supplies = \$20,000 + \$100 per student
(Accounting Dept.)
+ \$500 per faculty member

CAMPUS would then determine the number of students and number of faculty members, for this particular time period (say quarter).

For example:

Computer Supplies = \$20,000 + \$100(100) + \$500(10)
(Accting. Dept., Fall
Quarter - 1969/70) = \$35,000

There are 50 indicators of cost center activities available in CAMPUS. These indicators are known as functional or proportional bases. They are listed on Figure 3.

The Command Structure in CAMPUS:

The basic command structure in CAMPUS is displayed schematically on Figure 4. There are three levels of "commands;" only level one commands are shown on the Figure branching from "MAIN" - INPUT, DATA, REPORT, SIMULATE, EXPERIMENT, FINISH. These six level one commands, control the overall running of the model. Level two and Level three commands are shown on Figure 6; and are discussed below.

The CAMPUS Subroutine Calling Sequence:[1/]

CAMPUS V consists of 20 subroutines. These subroutines are called as shown on Figure 7.[2/] The level one commands are used as desired during the simulation to call, - - - ZEROIN: A subroutine that zeros out various matrices; INMOD: A subroutine that reads in the data; INOUT: A subroutine that structures and prints "input data reports;" RPTCON: A subroutine that prints OVERTIME reports; and SIMCON: A subroutine that controls the simulation.

Once SIMCON has been called, it takes control of the simulation. First, it calls STDADD, a subroutine that controls student admissions. ACSCAN (Activity Scanning) builds up the contact hours per week for each activity and resource; and also builds up enrollee load at the cost center, and program. REVOUT reports revenue information. CCNTL (Cost Center Control) is called from SIMCON each simulation period.

Depending on the need of a particular simulation, CCNTL may call any or all of the ten subroutines shown. Each of these ten subroutines includes the logic for handling a certain portion of each

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[1/]A detailed description of each subroutine is available in [Judy et. al., 1970, Vol. 3].

[2/]Refer to Figure 7 during this description.

cost center's resource calculations as follows: ACBILD builds up the required contact hours for the various resources directly associated with activities. ACBILD determines the number of sections of each activity. ACSTAF, ASSTAF, and NASTAF are concerned with Academic Staff, Academic Support Staff, and Non-Academic Support Staff.[1] TSPACE and OFFICE handle the many manipulations associated with Teaching Space (classroom instructional and special labs) and Office Space, respectively. The purpose of SPMAT is to calculate space shortages, maintenance costs, and construction costs. ACCOST converts the contact hours for each activity (available from ACBILD) into cost per activity (based on costs determined in the staffing and space subroutines). SERMOD calculates the resources required by service departments. Cost center reports are then prepared by CCOUT.

While the author is sure that the above description of the calling sequence has been a "blur" to the reader, it does help provide an overall impression of how the model works and some insight into the level of complexity. The sections that follow will expand on the inputs, the process, and the outputs of these subroutines.

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[1] For a detailed description of the calculations associated with these three subroutines, see [Project PRIME Report No. 6].

CAMPUS INPUTS

The best procedure for understanding the CAMPUS model is to study in great detail the inputs. In this way the reader can develop a "feel" for how CAMPUS operates and at what level of detail. Figure 6 outlines the level 2 and 3 commands associated with the level 1 command - INPUT. These 72 level 3 commands (e.g. DEFINE 01, ACTIVITY 01) are the specific card formats required by the model.[1/] Figure 7 is an example of one level 3 command - ACTIVITY 06. From observing the figure you will note that data for two activities (courses) require 66 columns on the ACTIVITY 06 card.

Returning to Figure 6 you will observe that that are 14 level 2 commands in the level 1 input command (e.g. DEFINE, ACTIVITY). Each of these level 2 commands will be outlined briefly below.

CAMPUS Level 2 Commands:[2/]

DEFINE: This level 2 command "defines" or structures the institution's programs and cost centers (departments).

ACTIVITY: Activities (courses) are related to programs (degrees) through the use of participation rates. This relationship will be explored in depth below. Also established are the lengths of the degree programs (2 years, 4 years, etc.) and the numbers of credits needed for graduation.

STUDENT: Both freshmen and entering advanced standing students are input in this section. Drop-outs and transfers from major to major are also entered in this section.

STAFF AND XSTAFF: Staffing units required for each teaching and non-teaching duty are entered here, plus salary and office space. Hiring and promotion policy variables are also part of this input.

SPACE AND AVLSPACE: There are four types of space in this section: classroom, instructional labs, special labs, and service department space. Operating costs, construction costs and service characteristics (e.g. air-conditioning) are also needed.

SERVICE: Inputs are needed for staff, space, cost, and equipment associated with service departments.

EQUIPMENT: Cost and type of teaching equipment.

REVENUE: By source and use.

[1/] Project PRIME Report No. 12 explains in detail the format of these level 3 commands.

[2/] During the subsequent discussion reference to Figure 6 will facilitate understanding.

MISCELLA: Forms for developing miscellaneous resources (e.g. benefits, travel expenses).

INREPRT: Enables user to call for "input data" reports.

OUTREPR: Enables user to call for "cost center" reports.

OVTIME: Enables user to call for "Overtime" reports.

Activity Inputs:

A key series of data inputs for CAMPUS are associated with activities (courses). Note from Figure 6 that there are 8 level 3 commands (input formats) associated with the level 2 command - ACTIVITY. The first 6 refer to "regular" activities, whereas ACTIVITY 07 and 08 are concerned with "exception" activities. Regular activities will be explained first.

The key level 3 command is ACTIVITY 06 shown on Figure 7. From Figure 7 we observe that each activity (course) requires the following data:

ACTIVITY NUMBER CODE: A sequentially numbered "tag" for each activity - 980 are allowed.

ACTIVITY CALENDAR CODE: The course number from the college bulletin.

COST CENTER CODE OF AFFILIATION: Which academic department (from Figure 1) sponsors the course.

ACTIVITY TYPE CODE: On the Level 3 command ACTIVITY 01 the user can define the "activity type." Activity type determines the amount of "credit" given to academic staff for teaching this course.

SPECIALTY TYPE CODE: The type of academic specialties[1/] required to teach this course (from ACTIVITY 02).

SUCCESS FACTOR: Probability of completing course with a passing grade.

ACTIVITY CREDITS: Self explanatory.

SCHEDULE RANGE CODE: A code, developed on ACTIVITY 03, providing the course meeting time - day or night, its hours/meeting, and its number of meetings per week.

SECTION SIZE RANGE CODE: A code, from ACTIVITY 04, that determines the minimum, desired, and maximum "section size."

RESOURCE COMBINATION CODE: The resource combination is used to affix resources to activities. Each resource combination code

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1/See [Gulko, June 1970] for a discussion of the HEGIS "specialties".

can have a maximum of three resources, from the seven available resource types shown in Figure 8. Fifty resource combinations are allowed in the CAMPUS V model. Associated with each of the seven resource types are various numbers of "sub-types." The user provided a definition for each sub-type by using specified level 3 commands. For example, referring to Figure 8, we see four sub-types for the Academic Support staff (e.g. Teaching Associates I). The four sub-types were defined on a Level 3 command - STAFF 04. Similarly, classroom space sub-types are defined on SPACE 04; instructional labs on SPACE 06; and teaching equipment on EQUIPMEN 01.

Exception Activities:

A regular activity becomes an "exception" for one of the following reasons:

(a) The quantity of a resource is greater or less than one per activity (e.g. two teachers per section).

(b) The cost center of affiliation of some or all the resources is other than the cost center of affiliation of the activity consuming those resources (e.g. the Engineering Department offers an English activity (course) for which it draws a staff member from the English Department).

(c) The resource schedule differs from the activity schedule, (e.g. an activity which meets for five periods a week requires certain equipment for only two of those periods).

(d) The activity has a unique schedule range.

(e) The activity has a unique section size range.

In order to handle "a" above, exception activities have associated with each resource a "functional" or "proportional" basis. However, the proportional basis associated with exception activities include only three options rather than the 50 shown on Figure 3. The three options are:[1]

Option 1: The digit 1 implies that the average weekly resource hours required are computed as follows.

$$\text{Resource Hours} = \frac{\text{(Contact Hours)*(Quantity)}}{\text{Length of Simulation Period}}$$

Where:

"Contact Hours" is the total number of hours that the activities which use this resource meets during a simulation period;

[1] These examples were developed by Dr. Gary Andrew.

"Quantity" is the number of units of the resource required for one contact hour of the activity; and

"Length of Simulation Period" is expressed in weeks.

Example of 1

A certain CCTV course (activity) required the use of one studio for live transmission one hour per day, three days a week, 12 weeks in the period. Hence, the number of "Contact Hours" is 36 hours per quarter. The "Quantity" is one studio hour per contact hour. The calculation is then:

$$\frac{36x1}{12} = 3 \text{ Studio hours per week.}$$

Option 2: The digit 2 implies that the average weekly resource hours required is computed as follows.

$$\text{Resource Hours} = \frac{\text{(Contact Hours)*(Quantity)*(Enrollment)}}{\text{Length of Simulation Period}}$$

where:

"Contact Hours" is defined above;

"Quantity" is the number of units of the resource required per enrollee contact hour;

"Enrollment" is the total number of students that are enrolled in the activity; and

"Length of Simulation Peirod" is expressed in weeks.

Example of 2

Every two students in the CCTV course mentioned above share a piece of equipment during the actual TV broadcoast. The "contact hours" are computed as before but the Quantity is now 0.50 (i.e. 1/2 unit of equipment is required for one hour for each student hour). Hence, if there are 48 students enrolled in the course, the result will be

$$\frac{(36)*(0.50)*(48)}{12} = 72 \text{ hours of the resource required per week.}$$

Option 3: The digit 3 implies that the average weekly resource hours required are computed as follows.

$$\text{Resource Hours} = \frac{\text{(Contact Hours)*(Quantity)*(No. of Sections)}}{\text{Length of Simulation Period}}$$

where:

"Contact Hours" is as defined above;

"Quantity" is the number of units of the resource required per section hours;

"Number of Sections" is the number of small groups into which the activity has been divided; and

"Length of Simulation Period" is expressed in weeks.

Example of 3

Every section required a TV Monitor. Hence, "Quantity" is one TV Monitor per section and, assuming two sections, there will be an average weekly demand of nine hours per week of TV Monitor generated by the above mentioned activity:

$$\frac{(36)*(1)*(2)}{12} = 9 \text{ hours per week of TV Monitor}$$

THE CAMPUS PROCESS

Since CAMPUS is a comprehensive resource analysis model, it must consider the multiple missions of institutions of higher education. The program structure shown on Figure 2 is constructed to classify the primary missions or objectives of higher education (INSTRUCTION, RESEARCH, PUBLIC SERVICE) and also to classify the support missions (ACADEMIC SUPPORT, STUDENT SUPPORT, INSTITUTION SUPPORT).[1/]

In simulating these missions the CAMPUS model utilizes several "processes" including: (a) an instructional process; (b) a student flow process; (c) non-teaching duty process; (d) a service department process; and (3) a miscellaneous resource process.[2/]

The Instruction Process:

The Instructional process in CAMPUS is one of the model's key strengths because it "forces" the user to define his degree - curriculum - course relationship. Before exploring the instructional process we need to expand slightly on the list of definitions.

CREDIT RANGE: Level of academic standing. A typical four-year degree program has four credit ranges, i.e. freshman, sophomore, junior, senior.

PARTICIPATION RATE: Probability of taking a course.

CURRICULUM: A set of activities (courses) and their corresponding participation rates.

Figure 9 is a schematic representing the CAMPUS instructional process. Starting from the left side of the diagram the process begins with each student being grouped into a program element (a degree major).[3/] Associated with each degree (program element) are a varying number of curricula. One curriculum is required. for each simulation period (quarter)/credit range combination. A typical four-year degree would contain 12 curricula - three simulation periods (quarters) times four credit ranges (see above). Continuing to move from left to right on Figure 9, we note that each curriculum consists of a number of activities each with an assigned participation rate. As

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[1/] These six "programs" are part of the WICHE Program Classification Structure, [Gulko, June 1970].

[2/] These 5 processes have been given names by the author to aid the discussion. They are not generally used by other CAMPUS users (nor are any other since the developers of CAMPUS have written very little about the internal calculations of the model).

[3/] It is possible to have a group of students seeking undesignated degrees.

noted previously, each activity is associated with and draws resources from an academic department (cost center).

To improve the readers understanding of the Instructional process, Figure 10 presents some sample data. The Figure is one of the "input data" reports available from CAMPUS. First, we note on the top that this report is for the University of Minnesota - School of Business, 1969/70. Then starting from the left, we note that this is "program node" 13, MBA-day degree. The first curriculum shown, curriculum number 160, is for credit range one (1st year Masters) and for simulation period one (fall quarter); and it includes 15 courses. Each activity or course has an assigned participation rate (e.g. Activity No. 159-75%) representing the probability of a 1st year MBA student taking this course in Fall Quarter (1969/70). Continuing down the page, we note that curriculum number 162 (1st year MBA, Winter Quarter) includes 12 courses. Since an MBA degree is a two academic year program, the program element MBA day will have six curricula (2 credit ranges x 3 simulation periods).

Once the user has constructed the relationship between degrees - curricula -activities-participation rates he is ready for the Student Flow Process.

The Student Flow Process:

There are several key input variables which determine the resultant student flow in CAMPUS including:

SUCCESS FACTORS: Each activity (course) has associated with it a success factor, i.e. the probability of passing the course.

TRANSITION RATES: The probability of "dropping out" per quarter by program (degree) and by credit range (academic standing).

PROGRAM TRANSFERS: The probability per quarter at a certain credit range of "changing major."

STUDENT CREDIT LOAD: For each degree major and quarter, four credit loads and the % of students in this load are required inputs. For example,

Student Credit Load (In Credits)	Student Participation (%)
3	10
6	20
9	50
12	20

CREDITS/CREDIT RANGE and PROGRAM DURATION: For each degree major being simulated, a required credits per year (e.g. 45) and a degree length (e.g. four years) are required input. From this the model interprets that 180 credits are needed for graduation.

THE INSTRUCTION PROCESS: The degree-curriculum-activity-participation structure discussed above is a crucial input (schematically portrayed on Figure 9).

Once these variables have been provided to the model using the level 3 commands (Figure 6), the model is ready for students. CAMPUS accepts two types of students: "Freshmen" - new entrants with no academic credit; and "Advanced Standing" - entrants with some academic credit.

Input on new entrants is required by degree major, whereas advanced standing students must be labelled both by degree major and credit range. Figure 11 is an"input data report" that indicates the "initial distribution of students into programs." Note from the figure that 700 new entrants entered fall quarter 1969/70 (Simulation Period 1). These freshmen distribute themselves into degree majors as follows: 60 in "BSB-accounting;"1/ 242 in BSB regular; etc.. Since the report shown on Figure 11 was for the 1st simulation period in a particular experiment, the advanced standing students (new entrants directly into each program) is large because of a requirement to "fill the pipeline" with students.2/ Subsequent years would only include advanced standing students.

The reader will note that to this point the student input discussed above is all exogenous to CAMPUS. However, once the new entrants and advanced standing students are determined (each quarter of the simulation) the student flow process will "flow" students from Freshmen to Sophomore to Junior to Senior to Graduation. But how does it flow students? First the reader should briefly refresh himself on the structure of the CAMPUS instructional process depicted on Figure 9. Recall that each curriculum shown on the figure is for one quarter (simulation period), for one credit range, and for one degree major. An example curriculum is shown on Figure 12. On the figure, we see that this curriculum has five courses and is being taken by 130 freshmen majoring in BSB-Accounting, in Fall Quarter 1969/70. These freshmen place a total "Student credit Load" on the system of 1098 student credits.

A student credit load value is also provided to the model, "sliced" into credits as shown on Figure 13. The model will adjust the student particiaption" on Figure 13 until the total student credit loads are equal on both Figures 12 and 13.3/

1/BSB-Accounting is Bachelor of Science in Business with an Accounting major.

2/From Figure 11, 60 freshmen enter program 10 - BSB-Accounting; 70 freshmen were in the system that had not advanced to credit range 2 (sophomores). The credit range 2, 3, and 4 students represent an inital inventory of Sophomores, Juniors, and Seniors, respectively; plus new entrants.

3/The model assumes that "student credits" calculated from the curriculum-activity (Figure 12) is correct.

We need one other input before the actual student flow process is explained - an initial inventory of students. Figure 14 shows the distribution of BSB-Accounting students at the beginning of Fall Quarter 1969/70. One new item has been introduced on the figure - subranges (8 categories of 6 credits each). Subranges, are provided to enable the model to have a "storage location" for students at various stages of their academic progress.[1/] Referring again to Figure 14, we see that there are 60 new freshmen in subrange 1, and 70 (6 x 9 x 2 x 8) advanced standing freshmen distributed uniformly in the subranges 1-8. Also there are 120 (8 x 15) sophomores spread uniformly in the credit range 2 subranges.[2/] The reader will recall that the 50 new freshmen, 70 advanced standing freshmen, and 120 sophomores appeared as input on Figure 11.

Now we are ready to explain the student flow process. Beginning with the inventory of students from Figure 14, the flow model advances students into appropriate subranges, based on a gross success factor as explained below. The resulting distribution of students after this manipulation is shown on Figure 17. This manipulation works as shown on Figures 15 and 16.

The columns on Figure 15 have been labelled to facilitate the discussion. Column 2 includes the number of students attempting the 4 credit loads (i.e. 3, 6, 9. 12). Column 3, the gross success-factor, is based on a calculation that determines the total student credits obtained divided by the total student credits attempted - for this degree major and credit range.[3/] Column 4 is arrived at by multiplying column 1 x column 2 x column 3.

To calculate columns 5-7, the number of subranges that these freshmen accounting students advance at the end of fall quarter 1969/70, the model first determines the maximum possible advanced (in subranges) as follows:

Credit Load (1)	Credits Per Subrange (2)	Maximum possible integer Advance (in Subranges) (3) = (1) : (2)
3	6	0
6	6	1
9	6	1
12	6	2

1/ There is no significance to "8" subranges, in fact, the CAMPUS V model has only four. (However, the MINNESOTA versions of CAMPUS has increased the subranges to 8 in order to "smooth" student flow.) The author has used 8 subranges in the example because it prevents confusion between 4 subranges and the 4 credit loads (i.e. 3, 6, 9, 12).

2/ CAMPUS V distributes advanced standing students uniformly in each subrange. Subsequent modifications to the Minnesota version of the model allow an input to determine the "distribution" of advanced standing students (e.g. 60% subrange 1, 30% in subrange 3, 10% in subrange 3).

3/ In CAMPUS V the gross success factor is identical for all credit loads, as shown on Figure 15. The Minnesota version of CAMPUS allows the gross success-factor to vary by credit load attempted.

Secondly, the model enters each row (each credit load) and makes a series of calculations that are best explained by using Figure 15. For row 1, since the maximum possible advance is 0, all 25 students are placed in column 5. The maximum advance for row 2, is 1 so the model multiplies the gross success factor times the number of students in row 2 and places this value (80% x 13 = 10) in column 6, row 2. The remaining students in row 2 are then placed in column 5 (3 students). The calculations for row 3 are identical to row 2, resulting in 42 students (80% of 53) in column 6 and 11 in column 5. Starting with column 7, row 4, the model again calculates 80% of the students (39 x 80 = 31) and places these in the maximum subrange advance column (Number 7 in this case). Using the remaining 8 students as a base (39-31), the model multiplies the gross success factor times the remaining students and places these 6 students into column 6 (8 x 80 = 6). Finally, the last 2 students (39-31-6 = 2) are placed in column 5.

After summing columns 5 through 7, the model calculates total student credits implied by the subrange advances. Using the example:

Total Student Credits = 41x0 + 58x6 + 31x12

= 720

Since the total student credits implied by the subrange advance (720) is lower than the obtained student credits (878), the model makes the following calculation:1/

$$\frac{878 - 720}{12} = 13 \text{ students}$$

The 13 students are then transferred from the zero-subrange advance column to the two-subrange advance column.

The next step is to "advance" the 130 freshmen students. Recall that at the start of Fall Quarter these freshmen were distributed into subranges as shown on Figure 14. In order to advance the 130 students the model makes the calculation shown on Figure 16. Each row of Figure 16 is calculated by using the student advanced by subranges, converted to a % as follows:2/

Subrange Advance	Students	% Subrange Advance
0	28	21
1	58	45
2	44	34

Row 1, Figure 16 is calculated by multiplying the % subrange advance times the 69 students in credit range 1, subrange as follows:

1/The model's calculation is more general, but the simple example shown illustrates the point. The calculation is needed to equalize the obtained student credits with the total student credits implied by the subranges of advance.

2/The students are obtained distributed into subranges of advance from Figure 15.

69 x 21% = 15 students advance 0 subranges

69 x 45% = 31 students advance 1 subrange

69 x 34% = 23 students advance 2 subranges

Each of the 8 rows is calculated in a similar manner and then each column is summed. At the end of fall quarter 1969/70 the 130 freshmen students who started the quarter distributed as shown on Figure 14 are now distributed as shown on Figure 17. Note that in Figure 17, the sophomores have not been advanced, since a series of calculations similar to that shown on Figure 12 thru 16 is required.

Once the manipulations explained above are complete, there are three additional matters to handle: (1) drop-outs; (2) program transfers; and (3) graduates. Items (1) and (2) are handled using "transition rates" and "program transfers." These two probabilities (expressed as percentages) are applied to the students in a particular program, credit range, and simulation period (quarter). As an example, say that BSB-Accounting, freshmen, fall quarter, have a 6% probability of "dropping out" and a 12% probability of transferring to another degree, e.g. BSB-regular.1/ Applying the two probabilities to the 130 BSB-Accounting freshmen students, we see that 8 drop-out and 16 transfer at the end of the fall quarter 1969/70. The flow model assumes that drop-outs and transfers are evenly distributed in the 8 subranges and therefore deletes three students from each subrange.

Item (3), graduates, is handled as follows: since students progress through the system as explained above, many will advance beyond the last subrange of the last credit range (4-senior). The model counts students in this category and labels them "graduates."

Non-Teaching Duty Process:

The third process associated with CAMPUS V is the "Non-teaching duty" process. Its primary task is to enable the simulation model to develop resources for all faculty activities that are not directly related to "activities." Categorization of these non-teaching duties (NTD) is an interesting and difficult problem, but for our purposes representative activities include: research and scholarly activities; faculty public service; departmental services; student support services; institutional services; and professional development. (For a detailed discussion and time study of faculty activities see Project PRIME Report No. 6.)

The CAMPUS NTD Process can handle a maximum of 5 types. Faculty staffing time for each type is determined with a "proportional basis."

1/Five program transfers are allowed, but only one is used in the example. Also transfers to BSB-Accounting are handled using similar logic.

One example of a useful proportional basis is: "number of academic staff" (Figure 3). Suppose that each staff member is allowed 8 hours per week for research and scholarly activities. As the model progresses in the simulation, each quarter it determines how many faculty are required. Each of these faculty is "required" to spend 8 hour/ week on research and scholarly activities. A second example might be departmental services. A decision prior to beginning the simulation might be that each department requires a one-half time chairman, each faculty allocates 4 hours per week for committee meetings and other administrative matters, and each faculty sets aside 1 hour per week for "affiliated" students.[1] The model would then do a calculation for each department, each quarter, as follows:

Number of faculty hours per week (Departmental Services)	(20 hrs./week) (1) + 4 hrs/week)(No. of Staff) = + (1 hr/week)(Number of Affiliated Students)

If, for fall quarter 1975, the model determined that 10 staff were needed and that there were 40 affiliated students; 100 faculty hours per week would be required for Departmental Services:

Faculty hours in Departmental Services = [20 x 1.0] + 4 x 10] + [1 x 40] = 100 hours/week

Service Department Process

The service department (SD) process in the CAMPUS V simulation model is used to develop resources for support and for research conducted within a designated organization, e.g. a research center. SERVICE is a level 2 input command (Figure 6). The four level 3 commands associated with SERVICE provide the resource analyst with the capability to build three types of resources (staff, space, and equipment) for non-academic cost centers. SERVICE 01 (1st level 3 command) is used to affiliate up to a maximum of 15 service departments with cost centers (Figure 18). From the figure each service department can be "affiliated with" either a cost center level or from 1 to 5 unique cost centers. One question that begs answering is - what does "affiliated with" mean?

The best way to understand the "affiliated with" problem is by an example. Referring to Figure 2 we note that INSTRUCTION is cost center number 3. We could, for example, "affiliate with" this cost center a service department entitled "counseling division." To determine the resource requirements for this counseling division we resort to the "proportional bases" concept. Using the SERVICE 02 Level 3 command (staff) as an example, we could determine the staff resources as follows:

---

[1]Affiliated students are those whose degree-major is controlled" by an academic department (e.g. Master of Science in Accounting is controlled by the Accounting Department so students in this program are affiliated with the Accounting Department).

(1) A chief counselor: Fixed at 1.0 (Absolute Proportional bases) no matter what the status of the institution.

(2) Assistant counselors: Say 1.0 fixed plus a variable number depending on the number of students. Recalling that the "counseling divison" is affiliated with the instruction cost center and the instrction cost center has 6 academic cost centers associated with it (Figure 2), the correct proportional basis is "aggregate number of students" - i.e. a headcount of all students in the institution.

(3) Secretary: Say 1.0 fixed plus a variable number also depending on the number of students. (The variable number would probably be different than for assistant counselors.)

Space and equipment resources would be developed in an analogous manner (except Level 3 commands SERVICE 03 and SERVICE 04). One comment, "equipment", is somewhat a misnomer for it can include many types of resources (e.g. gasoline expenses, cleaning supplies, computer expenses, maintenance supplies).[1/]

Miscellaneous Resource Process:

The primary purpose for including a miscellaneous resource process in CAMPUS is to enable the model to more accurately reflect the typical "line-items" found in traditional budgeting. Important line-items that appear in university and college budgets but not addressed by any of the other processes[2/] include as examples: travel expenses; recruitment-expenses; and supplies.

Each of these miscellaneous resource categories is "affiliated with" a specific cost center and has an associated proportional basis.

[1/] Equipment is the service department equivalent of miscellaneous resources.

[2/] Except for service department "equipment" - see previous footnote.

CAMPUS V OUTPUTS

There are three major groupings of output reports available in the present version of CAMPUS V: (1) Input Data Reports; (2) Cost Center Reports; and (3) Overtime Reports. The first group of reports is provided to collate the input information and develop it in a logical report format, thus facilitating an examination of the input data. There are 44 report formats available in 9 major categories as follows.

INPUT DATA REPORTS

Report Category	Description	Number of Report Formats
1	Program Structures and Departments	4
2	Activities	6
3	Programs and Students	4
4	Staff	7
5	Space	7
6	Space	6
7	Service Department	4
8	Revenue	4
9	Miscellaneious Resources	2
	Total	44

The second group of reports, the "COST CENTER Reports," is provided to aid the institution's managers, e.g. department heads, deans, etc. The present version of CAMPUS has seven major report types and 48 report formats as follows.

COST CENTER OUTPUT REPORTS

Report Category	Description	Number of Report Formats
1	Students and enrollees	2
2	Staff	5
3	Equipment	2
4	Service	2
5	Space	19
6	Space	8
7	Summary	10
	Total	48

A third group of available reports is called "OVERTIME Reports." These reports are for a session (year) as contrasted with the preceding two groups which are "single period (quarter)" reports. Up to 10 sessions are available.

OVERTIME REPORTS

Report Category	Description		Number of Report Formats
1.1	Student and Enrollee Load		1
1.2	Staff Costs		1
1.3	Space Requirements		1
1.4	Operating Costs		1
1.5	Summary Report		1
		Total	5

With 97 formats available, it is impossible to present an example of them in this report. Project PRIME Report Number 2 includes a short description of each report. This paper has included copies of 2 input data reports: Figure 10 (Input data report 3.1); and Figure 11 (Input data report 3.2).

Although the 97 report formats discussed above provide an institutional manager with a considerable amount of information, there are no reports on either degree costs or other program costs. Project PRIME Report No. 8 describes an extension to the model that will enable program costing, and includes a description of the 25 "Program Costing Reports."

Figure 1

Cost Center Structure
for a School of Business Administration

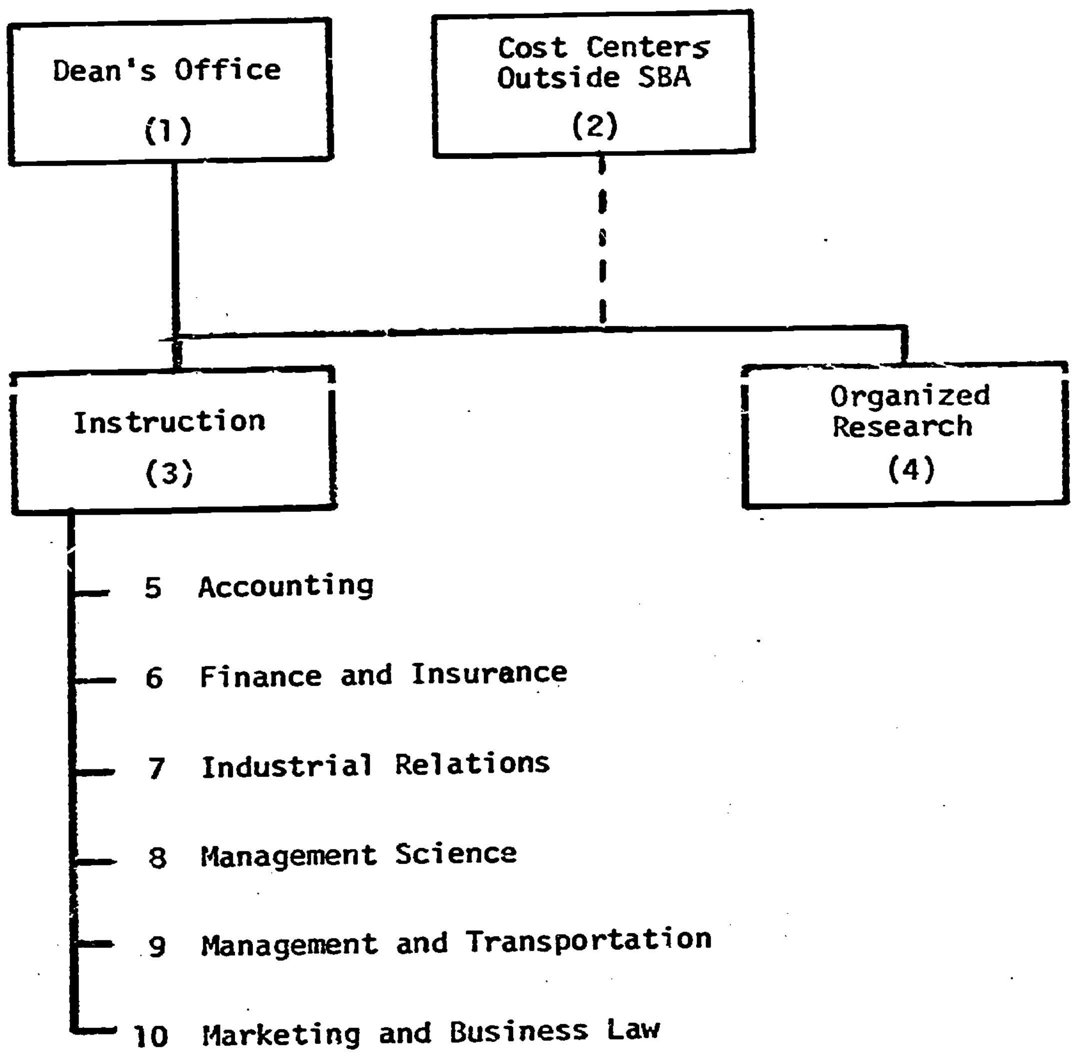


Figure 2a

Illustrative Program Structure for a School of Business Administration

PRIMARY

- 1.0 INSTRUCTION
  - 1.1 Undergraduate
    - BSB Accting
    - BSB Regular
  - 1.2 Graduate
    - Master of Business Administration (Day)
    - Executive Master of Business Administration (Evening)
    - Master of Arts - Industrial Relations
    - Ph.D. - (10 program elements)[1]
    - Master of Science - (10 program elements)[1]
- 2.0 RESEARCH
  - 2.1 Organized Research
    - Center for Experimental Study of Business (CESB)
    - Industrial Relations Center (IRC)
    - Management Information Systems Research Center (MISRC)
  - 2.2 Department Research
    - Summer Research
    - Department Research
- 3.0 PUBLIC SERVICE
  - Continuing Business Education
  - Bureau of Business Research
  - Faculty Public Service

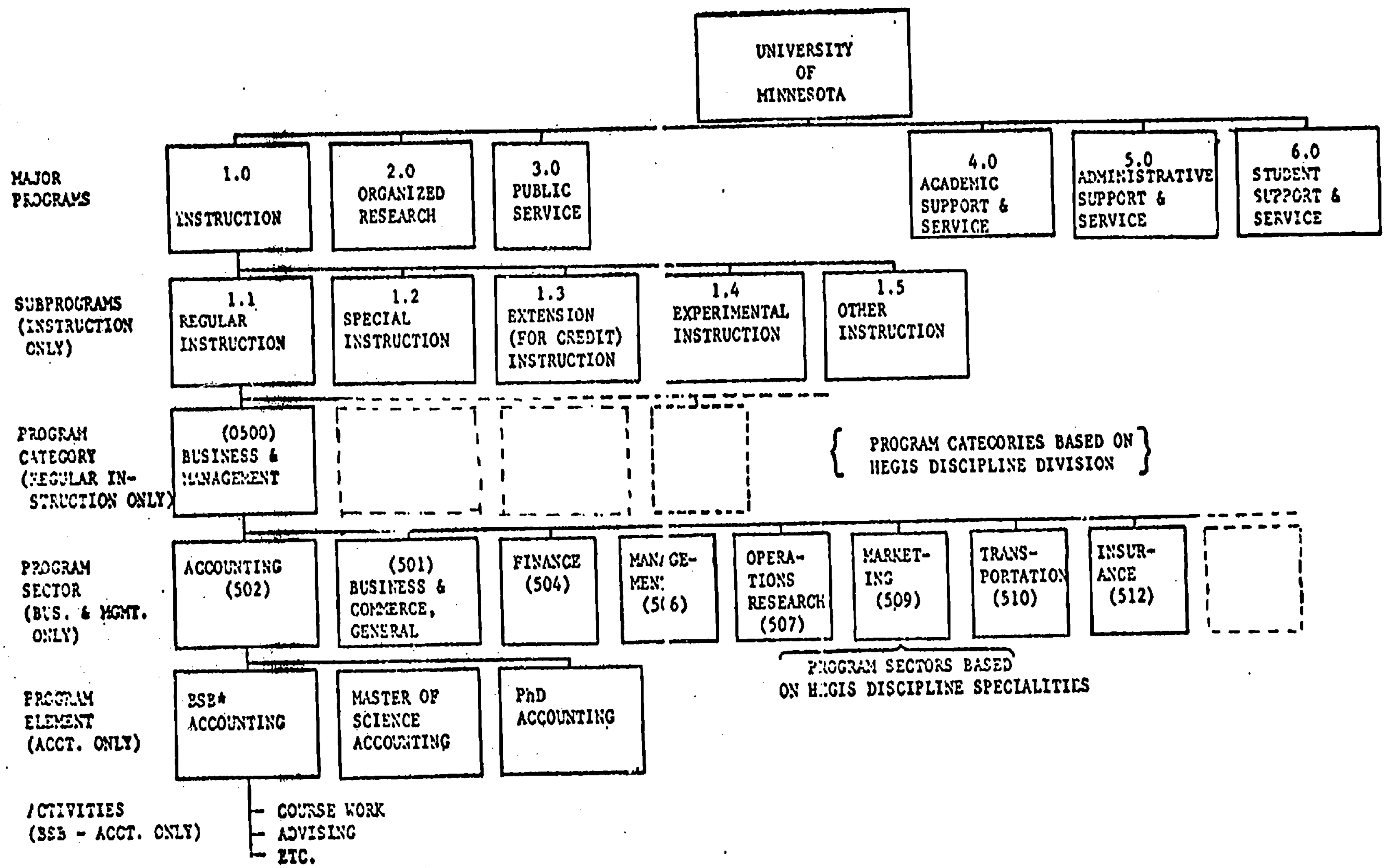
SUPPORT

- 4.0 ACADEMIC SUPPORT
  - Computer Center
  - Industrial Relations Library
  - Business Reference Library
  - Department Administration and Committees
  - Professional Development
- 5.0 STUDENT SUPPORT
  - Pre-Business Counseling
  - Graduate Studies
  - Placement
  - Student Support - Faculty
- 6.0 INSTITUTION SUPPORT
  - College Administration
  - Administrative Services
  - Committees - College Wide

[1] Each element is a degree major: Accounting, Finance, Industrial Relations, Management, Management Information Systems, Marketing, Production, Quantitative Analysis, Insurance, and Transportation.

Figure 2b

Illustrative Program Structure
for a
School of Business Administration**



* BSB = BACHELOR OF SCIENCE IN BUSINESS
** BASED ON WICHE-MIS FORMAT [Gulko, June 1970]

Figure 3

Functional Bases for the Calculation of
Indirect Resources at a Cost Center

Absolute Functional Bases:

Absolute Value	.01	(28)**
Absolute Value	.1	(27)
Absolute Value	1.0	(1)
Absolute Value	10.0	(29)
Absolute Value	100.0	(30)
Absolute Value	1000.0	(31)

Student Related Functional Bases*

Affiliated Students	(2)
Affiliated Students in 100's	(42)
Aggregate Affiliated Students	(5)
Aggregate Affiliated Students in 100's	(45)
Affiliated Enrollees	(3)
Affiliated Enrollees in 100's	(43)
Aggregate Affiliated Enrollees	(6)
Aggregate Affiliated Enrollees in 100's	(46)
Enrollee Load	(4)
Enrollee Load in 100's	(44)
Aggregate Enrollee Load	(7)
Aggregate Enrollee Load in 100's	(47)

Staff-Related Functional Bases*

Number of Academic Staff	(8)
Aggregate Number of Academic Staff	(12)
Number of Academic Support Staff	(9)
Aggregate Number of Academic Support Staff	(13)
Number of Non-Academic Staff	(10)
Aggregate Number of Non-Academic Staff	(14)
Total Staff	(11)
Aggregate Total Staff	(15)
Total Full-Time Academic Staff Hired	(35)
Number of Full-Time Staff	(50)

Figure 3 Con't

Cost Related Functional Bases*

Total Academic Staff Salaries (in thousands)	(32)
Aggregate Total Academic Staff Salaries (in thousands)	(37)
Total Academic Support Staff Salaries (in thousands)	(33)
Aggregate Total Academic Support Staff Salaries (in thousands)	(38)
Total Non-Academic Staff Salaries (in thousands)	(34)
Aggregate Total Non-Academic Staff Salaries (in thousands)	(39)
Total Staff Salaries (in thousands)	(36)
Aggregate Total Salaries (in thousands)	(40)
Operating Costs (in thousands)	(24)
Aggregate Operating Cost (in thousands)	(25)

Space Related Functional Bases*

Classroom Space (in Ft^2)	(18)
Aggregate Classroom Space (in Ft2)	(21)
Instructional plus special Laboratory Space(in Ft^2)	(19)
Aggregate instructional plus special laboratory space (in Ft^2)	(22)
Total Space (in	(20)
Aggregate Total Space (in	(23)
Number of Stations in a room	(48)
Number of Square Feet in a room	(49)

Program/Curriculum Related Functional Bases*

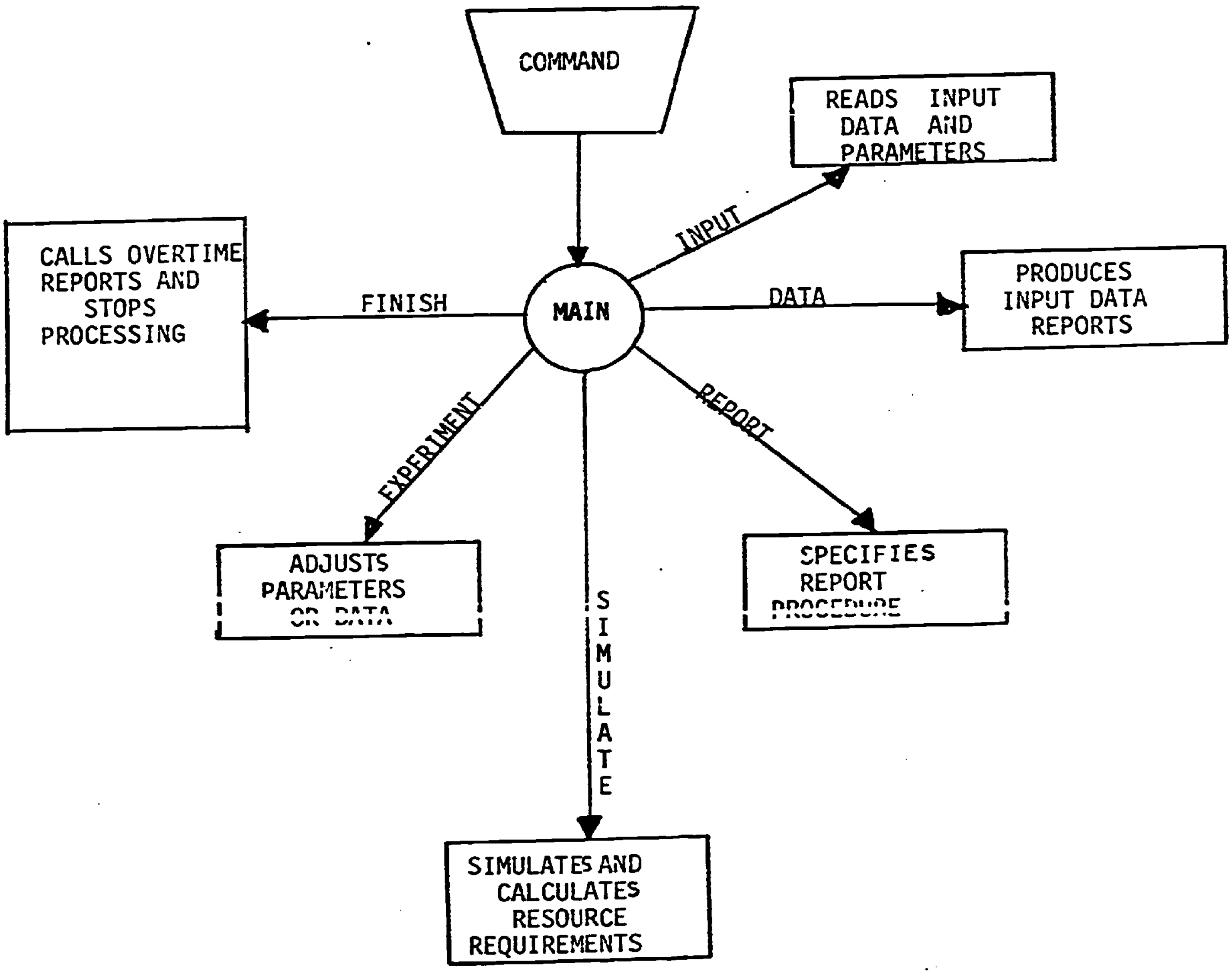
Number of Affiliated Programs	(16)
Aggregate Number of Affiliated Programs	(17)
Number of Directly Affiliated Cost Centers	(26)

*Each functional bases should include the words: "per cost center."

**Parenthesis refers to a code needed by CAMPUS model to recognize particular functional bases.

Figure 4

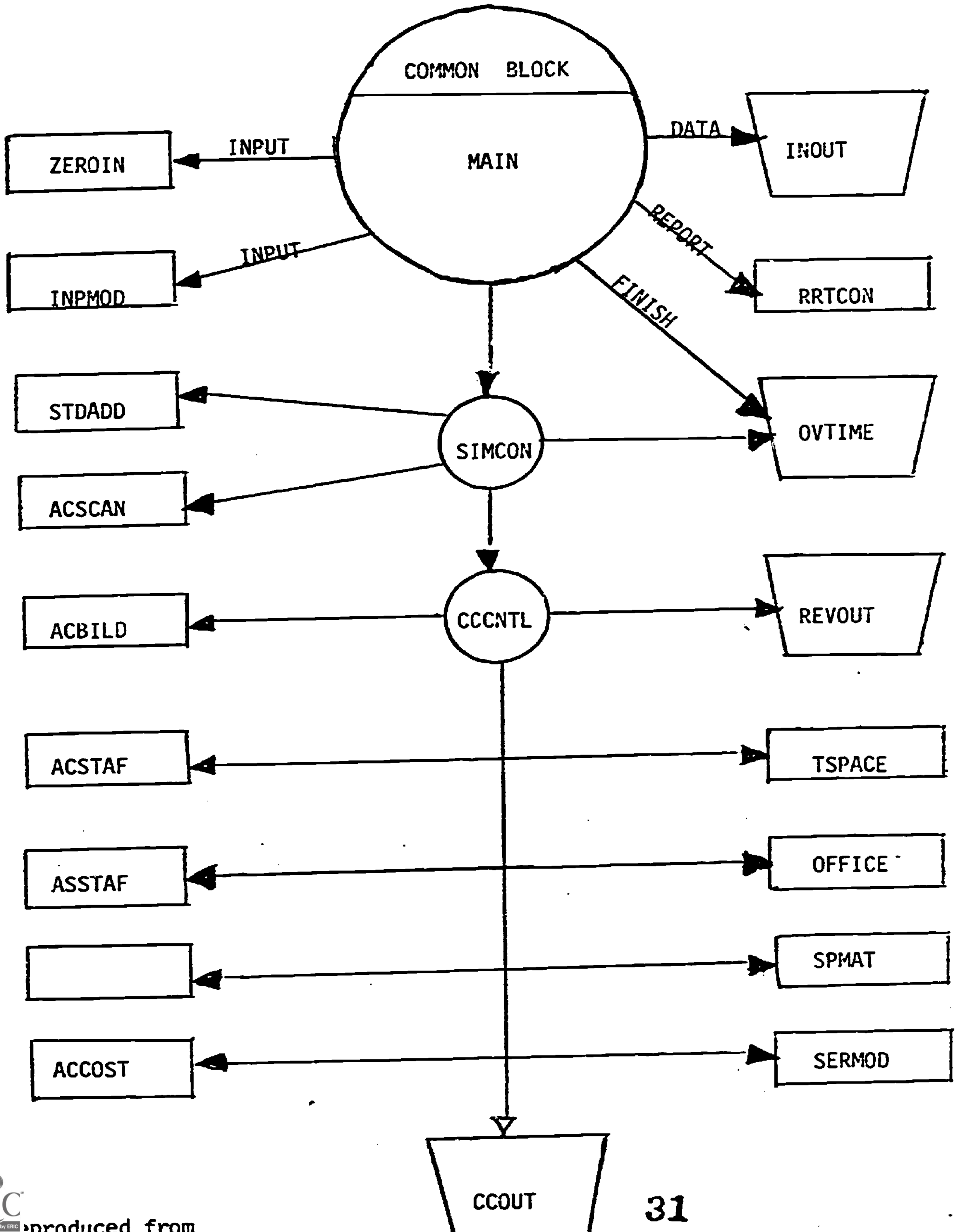
THE COMMAND STRUCTURE IN CAMPUS*



*[Sceviour; 1969: 19]

Figure 5*

CAMPUS SUBROUTINES



*Reproduced from [Judy, etal, 1970: Vol. 2]

Figure 6

Level 1 Command INPUT

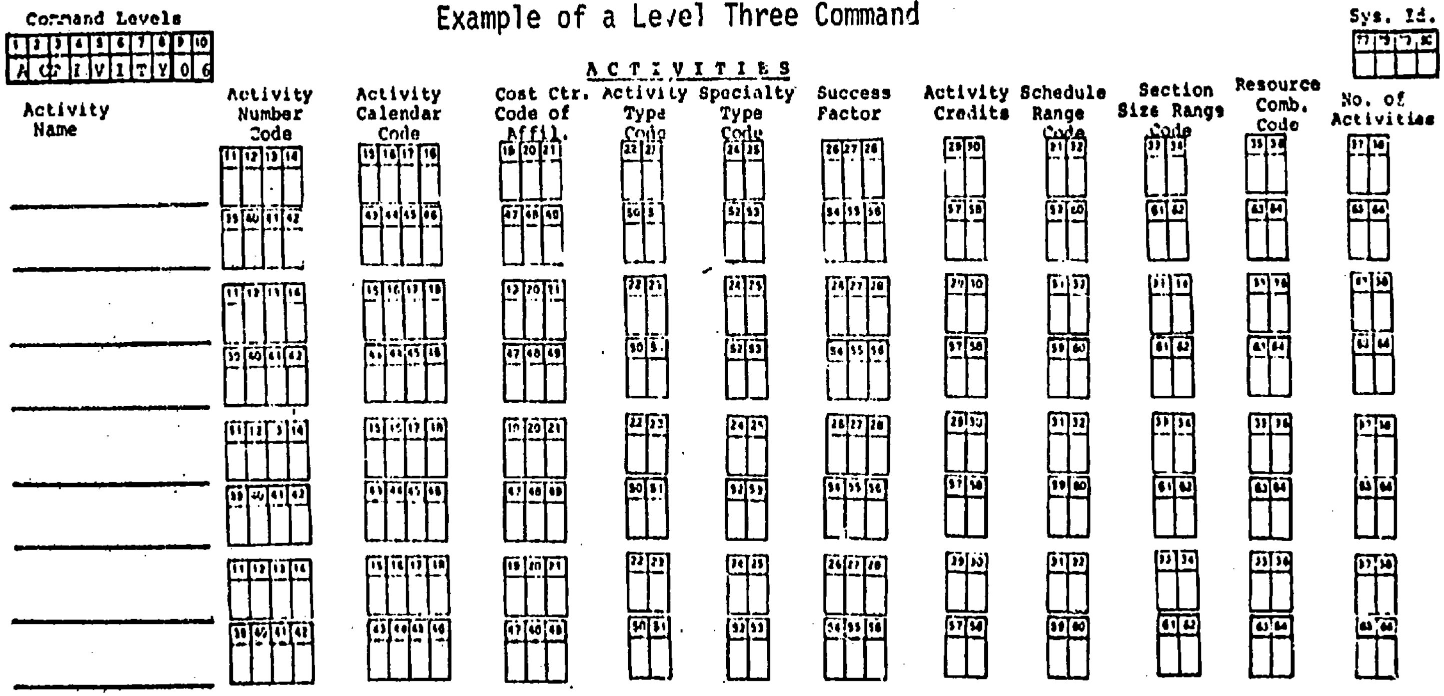
Index of Level 2 and Level 3 Command INPUT Documents

LEVEL 2	LEVEL 3	
DEFINE	01	Institution Name and Simulation Time Factors
	02	Cost Center Levels
	03	Cost Centers
	04	Program Levels
	05	Programs
	06	Program to Cost Center Affiliation
ACTIVITY	01	Activity Type
	02	Specialty Type
	03	Schedule Range
	04	Section Size Range
	05	Resource Combinations
	06	Activities
	07	Exception Activities
	08	Exception Resources
PROGRAM	01	Program Curricula
	02	Curricula Activities and Participation Rates
	03	Program Duration and Enrolment Update
	04	Credits Per Credit Range by Program
STUDENT	01	New Entrants to Institution with NO Academic Credit
	02	Distribution of New Entrants with NO Academic Credit
	03	New Entrants with Academic Standing
	04	Student Transitions
	05	Student Credit Load
STAFF	01	Academic Staff Ranks
	02	Academic Staff Activity Teaching Duties
	03	Academic Staff Activity Non-teaching Duties
	04	Academic Support Staff
	05	Non-academic staff
XSTAFF	01	Detailed Academic Staff Ranks
	02	Detailed Academic Staff Activity Teaching Duties
	03	Detailed Academic Staff Activity Non-teaching Duties
	04	Detailed Academic Staff Inventory, Transition and Hiring Criteria
	05	Detailed Academic Staff Optimization and Update Policies

Figure 6
(Cont'd)

SPACE	01	Classroom Sizes (stations)
	02	Laboratory Sizes (stations)
	03	Classroom Space Planning Factors
	04	Classroom Type Characteristics
	05	Instructional Lab. Space Planning Factors
	06	Instructional Lab. Type Characteristics
	07	Special Lab. Space Planning Factors
	08	Special Lab. Type Characteristics
	09	Service Space Characteristics by Type
	10	Cost Center Space Characteristics
	11	Service Code Specifications
	12	Space Category Codes, Names, Construction, and Maintenance Costs
	13	Miscellaneous Space Specifications
	14	Teaching Space Control Centers
AVLSPACE	01	Available Classroom Space
	02	Available Instructional Laboratory Space
	03	Available Instructional Special Laboratory Space
	04	Available Space by Category
SERVICE	01	Service Departments and Affiliations
	02	Service Staff
	03	Service Space
	04	Service Equipment
EQUIPMEN	01	Equipment Resource Characteristics
REVENUE	01	Characteristics of Revenue
	02	Revenue at Cost Centers
	03	Revenue at Programs
	04	Revenue of Service Departments
MISCELLA	01	Miscellaneous Resource Characteristics
	02	Miscellaneous Resource by Cost Center
INREPRT	01	Input Report Controls
	02	Comments
UTREPR	01	Output Report Control-Cost Centers
	02	Output Report Control-Program

Figure 7
Activity 06
Example of a Level Three Command



Explanation:

(a) Code across the page, one activity per line.
(b) Exception activities, as defined in the codi q manual, are not coded on this sheet.
(c) The full activity name should be written in or the coder's reference.
(d) If success factor and activity credits do no apply, leave blank.
(e) If activity type groups are not used, put a ne in number of activities.
(f) Use additional coding sheets of this type, a needed, to code all activities.

FIGURE 8

RESOURCE COMBINATIONS*

Code	Resource Type	Resource Sub-Type	Input Form
1	Academic Staff	1 part-time 2 full-time 3 general**	Fixed in Model
2	Academic Support Staff	1 teaching Assoc.I. 2 teaching Assoc.II 3 Teaching Asst. I 4 Teaching Asst. II	STAFF 04
3	Staff (spare)		Not Applicable
4	Classroom Space	1 Lecture 2 Seminar	SPACE 04
5	Instructional Lab Space	None	SPACE 06

* Used to develop level 3 command - ACTIVITY 05.

** Either part-time or full-time academic staff is acceptable, depending only on availability.

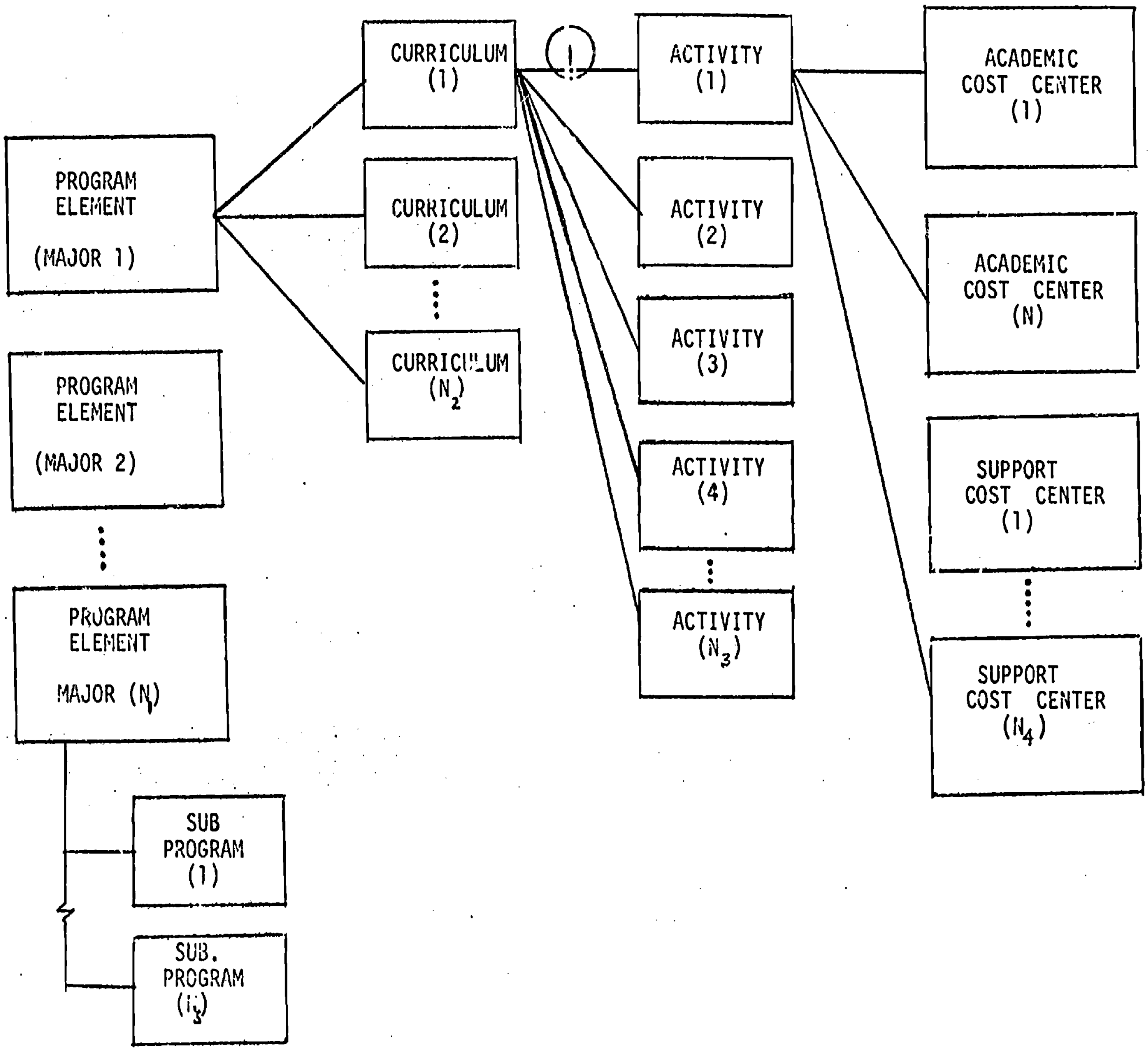
Figure 8

(Cont'd)

Code	Resource Type	Resource Sub-Type	Input Form
6	Special Lab Space	1 CRT-Blg 140	SPACE 08
		2 CESB Lab	
		3 MKTG 534	
7	Equipment	1 Computer	EQUIPME 01
		2 Terminal	
		3 Xerox	
		4 Typewriter	
		5 Calculator	
		6 CRT	
		7 A20 Machine	
		8 Telephone	
		9 Projector-Overhead	
		10 Projector-Slide	
		11 CCTV	
		12 Video Camera & Recorder	

Figure 9

CAMPUS INSTRUCTIONAL PROCESS



[1]Each activity has a corresponding participation rate.

Figure 10
INPUT DATA REPORT 3.1
CAMPUS INSTRUCTION PROCESS
UNIV. OF MINN--SCH OF BUSINESS
SESSION 1969-70

INPUT DATA REPORT 3.1
SOURCE DOCUMENTS PROGRAM 01
PROGRAM 02
PROGRAM 03
PROGRAM 04
DEFINE 05

PAGE 20

PROGRAM CURRICULA AND ACTIVITY PARTICIPATION

PROGRAM NODE	PROGRAM NAME	MAX. NO. YEARS-CREDITS	CREDIT YEARS	SIMULATION PERIOD	PROGRAM CURRICULUM NO. CODE	ACTIVITY NUMBER CODE	ACTIVITY CALENDAR CODE	ACTIVITY TYPE	PARTICIPATION RATE (%)
			2	2	163	322	PL 3	LECTURE3	10
						323	PL 3		10
						324	PL 3	LECTURE3	15
						325	PL 3		10
						326	PL 3	LECTURE3	40
						327	PL 3		15
						162	8009	LECTURE1	25
						163	8010	LECTURE1	50
						262	3064	LECTURE1	10
						206	8047	LECTURE1	20
						65	8100	LECTURE1	10
						285	G053	LECTURE1	50
						285	G053	LECTURE1	50
			2	3	165	322	PL 3	LECTURE3	10
						323	PL 3		10
						324	PL 3	LECTURE3	15
						325	PL 3		10
						326	PL 3	LECTURE3	40
						327	PL 3		15
						252	8159	LECTURE1	25
						163	8010	LECTURE1	30
						226	5100	LECTURE1	10
						138	8101	LECTURE1	20
						252	3064	LECTURE1	10
						99	5012	LECTURE1	20
						286	G053		50

Figure 10

INPUT DATA REPORT 3.1
CAMPUS INSTRUCTION PROCESS
UNIV. OF MINN--SCH OF BUSINESS
SESSION 1969-70

INPUT DATA REPORT 3.1
SOURCE DOCUMENTS PROGRAM 01
PROGRAM 02
PROGRAM 03
PROGRAM 04
DEFINE 05

PAGE 19

PROGRAM CURRICULA AND ACTIVITY PARTICIPATION

PROGRAM NODE	PROGRAM NAME	MAX. NO. YEARS-CREDITS	CREDIT YEARS	SIMULATION PERIOD	PROGRAM CURRICULUM NO. CODE	ACTIVITY NUMBER CODE	ACTIVITY CALENDAR CODE	ACTIVITY TYPE	PARTICIPATION RATE (%)
						302	PSY1	LECTURE1	20
						300	ECO1	LECTURE1	20
			1	3	164	252	8159	LECTURE1	75
						163	8010	LECTURE1	10
						226	5100	LECTURE1	20
						138	8101	LECTURE1	20
						262	3064	LECTURE1	20
						99	5012	LECTURE1	20
						95	5032	LECTURE1	20
						298	MATH		20
						83	8158	LECTURE1	20
						64	8000	LECTURE1	25
						301	ECO2		20
			2	1	161	322	PL 3	LECTURE3	10
						323	PL 3		10
						324	PL 3	LECTURE3	15
						325	PL 3		10
						326	PL 3	LECTURE3	40
						327	PL 3		15
						159	9005	LECTURE1	25
						161	9008	LECTURE1	25
						40	4260	LECTURE1	20
						65	8100	LECTURE1	10
						284	GOS3		100
						284	GOS3		100

Figure 10
INPUT DATA REPORT 3.1
CAMPUS INSTRUCTION PROCESS
UNIV. OF MINN--SCH OF BUSINESS
SESSION 1969-70

INPUT DATA REPORT 3.1
SOURCE DOCUMENTS PROGRAM 01
PROGRAM 02
PROGRAM 03
PROGRAM 04
DEFINE 05

PROGRAM CURRICULA AND ACTIVITY PARTICIPATION

PROGRAM NODE	PROGRAM NAME	MAX. NO. YEARS-CREDITS	CREDIT YEARS	SIMULATION PERIOD	PROGRAM CURRICULUM ID. CODE	ACTIVITY NUMBER CODE	ACTIVITY CALENDAR CODE	ACTIVITY TYPE	PARTICIPATION RATE (%)
13	MBA DAY	2 27							
			1	1	160	159	8005	LECTURE1	75
						161	8008	LECTURE1	75
						40	8260	LECTURE1	20
						65	8100	LECTURE1	10
						33	8050	LECTURE1	35
						243	8151	LECTURE1	35
						156	8061	LECTURE1	30
						64	8000	LECTURE1	10
						204	8000	LECTURE1	35
						95	5032	LECTURE1	10
						302	PSY1	LECTURE1	10
						300	EC01	LECTURE1	10
						83	8159	LECTURE1	10
						137	8100	LECTURE1	30
						268	8154	LECTURE1	30
			1	2	162	162	8009	LECTURE1	75
						163	8010	LECTURE1	10
						262	3064	LECTURE1	10
						206	8047	LECTURE1	20
						65	8100	LECTURE1	20
						34	8051	LECTURE1	35
						244	8159	LECTURE1	35
						220	8150	LECTURE1	30
						95	5032	LECTURE1	10
						304	SOC1	LECTURE1	20
						301	EC02		20
						83	8158	LECTURE1	20

Figure 11

UNIV. OF MINN--SCH OF BUSINESS
SESSION 1969-70

INPUT DATA REPORT 3.2
SOURCE DOCUMENTS STUDENT 01
STUDENT 02
STUDENT 03

PAGE 1

INITIAL DISTRIBUTION OF STUDENTS INTO PROGRAMS

SIMULATION PERIOD	NO. OF NEW ENTRANTS WITH NO ACADEMIC CREDIT ENTERING ALL PROGRAMS	PROGRAM CODE NAME	CREDIT RANGE OR ACADEMIC YEAR	NO. OF NEW ENTRANTS WITH NO ACADEMIC CREDIT IN EACH PROGRAM	NO. OF NEW ENTRANTS D I R E C T L Y INTO EACH PROGRAM	TOTAL PROGRAM
1	700	10-BSB ACCOUNTING	1	60	70	130
			2		120	120
			3		110	110
			4		100	100
						450
		11-BSB REGULAR	1	242	128	370
			2		360	360
			3		340	340
			4		320	320
						1390
		12-AGRI BUSINESS	1	50	10	60
			2		50	50
			3		45	45
			4		40	40
						195
		13-MBA DAY	1	90	20	110
			2		100	100
						210
		14-MBA EVENING	1	99	20	119
			2		100	100
			3		100	100
						319
		15-MA IR	1	50	5	55
			2		50	50
						105

Figure 12

An Example Curriculum*

For a degree major (program - BSB Accounting)

For a credit range (freshmen)

For a simulation period (Fall Quarter, 1969/70)

Student = 130

Activity (Course)	Participation Rate	Enrollees in Course	Credit Per Activity	Student Credits
A	50	65	3	195
B	20	26	4	84
C	50	65	3	195
D	60	78	3	234
E	100	130	3	390
				1098

*Similar to curriculum no. 160 shown on Figure 10 except this example has only 5 activities versus 15.

Figure 13

Student Credit Load

For a degree major (program - BSB Accounting)

For a credit range (freshmen)

For a simulation period (fall quarter 1969/70)

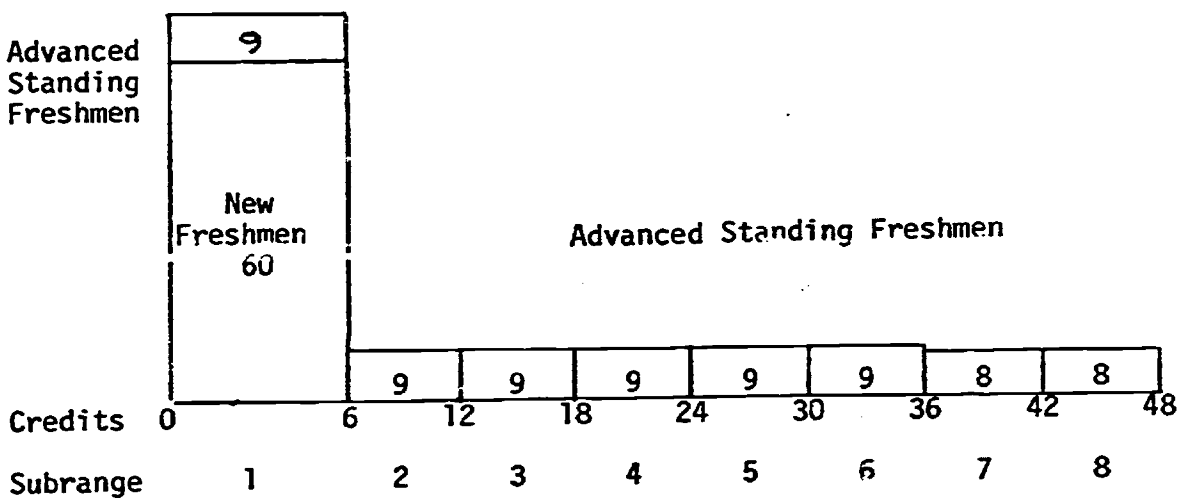
Students: 130

Student Credit Load (in credits)	Student Participation (%)	Student Participation (in students)	Student Credits
3	19	25	75
6	10	13	78
9	41	53	477
12	30	39	468
			1098

Figure 14

Distribution of BSB=Accounting Students into
8 Sub-ranges: Start of Fall
Quarter 1969/70

Freshmen (Credit range = 1)



Sophomore (credit range = 2)

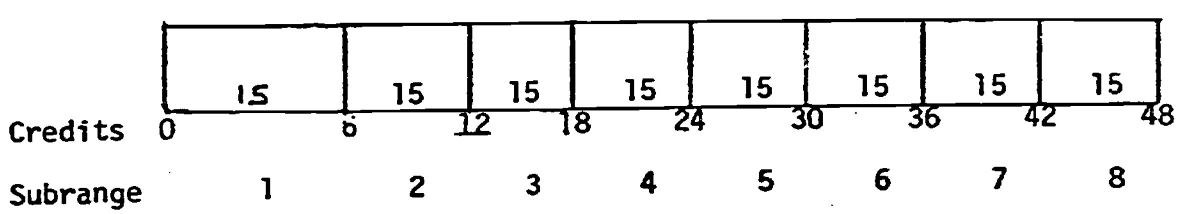


Figure 15

Determination of the Number of subranges, advanced By Credit Load
For Freshmen BSB-Accounting Students
Fall Quarter, 1969/70

Student Credit Load (In Credits) (1)	Attempted Student Participation (in credits)* (2)	Gross Success Factor ** (%) (3)	Obtained Student Credit Loac (In Credits) (4)	0 Subranges (No Credit) (5)	1 Subrange (6 credits) (6)	2 Subrange (12 credit) (7)	Total Student Credits (8)
3	25	80	60	25	-	-	0
6	13	80	62	3	10	-	60
9	53	80	382	11	42	-	252
12	39	80	374	2	6	31	408
	130		878	41	58	31	720
			Recalculated Value:**	28	58	44	876

* From Figure 13
** Explained in text

Figure 16

Determination of the Number of Subranges Advanced by Subrange Advanced For Freshmen, BSB-Accounting Students Fall Quarter, 1969/70

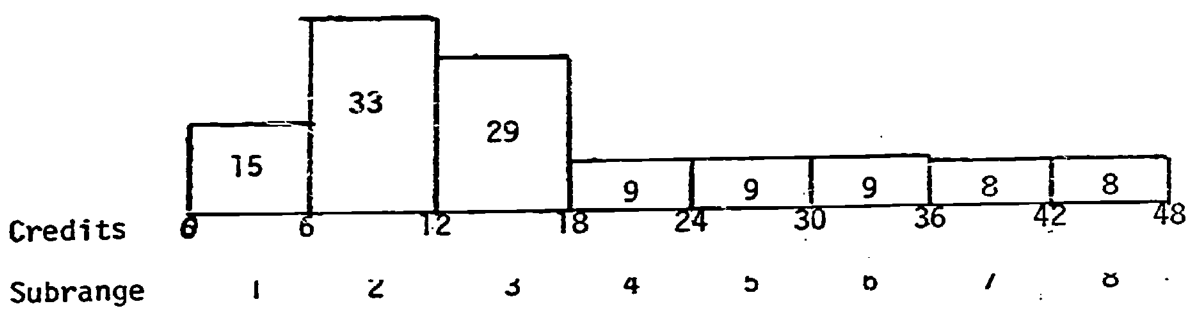
			Calculation of Students Subrange Advance									
			Credit Range 1 (Freshmen)								Credit Range 2 (Sophomore)	
			Subrange								Subrange	
Credit Range	Subrange	Number of Students Start of Fall Quarter*	1	2	3	4	5	6	7	8	1	2
1	1	69	15	31	23							
1	2	9		2	4	3						
1	3	9			2	4	3					
1	4	9				2	4	3				
1	5	9					2	4	3			
1	6	9						2	4	3		
1	7	8							1	4	3	
1	8	8								1	4	3
Summary of Advances			15	33	29	9	9	9	8	8	7	3

*From Figure 16

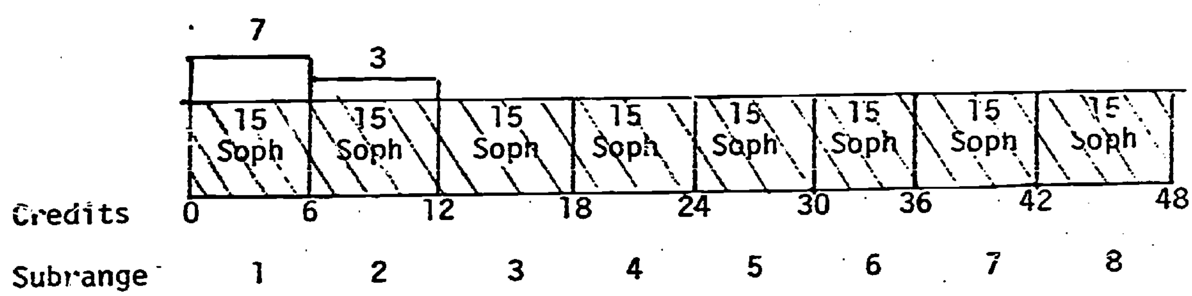
Figure 17

Distribution of Freshmen BSB-Accounting Students into 8 Sub-ranges: End of Fall Quarter 1969/70

Freshmen (Credit range = 1)



Sophomore (Credit range = 2)



*The cross-hatching indicates that for the example the sophomore students have not been advanced to the end of the quarter. Comparison of this Figure with Figure 14 is desirable.

Figure 18
SERVICE 01
SERVICE DEPARTMENT PROCESS

SERVICE DEPARTMENT CHARACTERISTICS

Command Levels

1	2	3	4	5	6	7	8	9	10
S	E	R	V	I	C	E		0	1

Sys. Id.

77	78	79	80

Service Dept. Code	Service Department Name	Cost Ctr. Level of Affil.	Cost Centers of Affiliation I	II	III	IV	V	Service Dept. Space Code
11–12	13–28	29	30–32	33–35	36–38	39–41	42–44	45–47

Explanation:

(a) Code across the page, one service department per line.
(b) Where service department is affiliated at more than one cost center level it must be redefined as a separate department at each level.
(c) Where service department is affiliated with all cost centers at one level, code only the level; leave cost centers of affiliation blank.
(d) Use additional coding sheets of this type, as needed, to code all service departments.

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Project PRIME Reports

Report Number	Description	Author
1	Test Implementation of CAMPUS (A Computer Based Simulation Model) for Higher Education Administration and Planning in Minnesota, March 1970.	Andrew, Cordes Lorents
2	An Introduction to Project PRIME and CAMPUS-MINNESOTA, November 17, 1970.	Cordes
3	PPBS in Higher Education: An Annotated Bibliography, May 1971.	Cordes
4.	PPBS in Education: Concept, Operation, Status, and a School of Business Administration Example.	Cordes
5.	Program Costing with the CAMPUS Simulation Model, June 1971.	Cordes
6.	Faculty Activity Analysis and Planning Models in Higher Education, June 1971.	Lorents
7.	A Faculty Activity Information Subsystems and CAMPUS-MINNESOTA, June 1971.	Lorents
8.	Operational Overview of the CAMPUS Simulation Model, June 1971.	Cordes
9.	Using a Planning Model in Higher Education, (in progress).	Fisher
10.	Resource Analysis Models in Higher Education: a Synthesis (in progress).	Cordes
11.	Converting CAMPUS V to CAMPUS-MINNESOTA (in progress).	Davitt
12.	CAMPUS-MINNESOTA User Information Manual, June 1971.	Andrew
13.	Applying Input/Output Analysis and the EL FYD Model to Higher Education (in progress).	Cordes
14.	Mid-Year Progress Report, January 1971.	Andrew, Cordes, Lorents
15.	Case Studies of Resource Simulation in Education (A High School; A Junior College; A State College and two Schools of a Large University, (in progress).	
16.	Final Report of Project PRIME (in progress).	Andrew, Cordes, Lorents